

WHAT IS CLAIMED IS:

1. A process for manufacturing a methacrylate (co)polymer comprising conducting polymerization while feeding a monomer (mixture) containing at least 90 wt% in total of at least one methacrylate monomer and a radical polymerization initiator represented by formula (II) into a reactor, where an initiator concentration and a polymerization temperature satisfy a relationship represented by equations (1) to (4) and the polymerization temperature is not less than 110°C and not more than 160 °C;

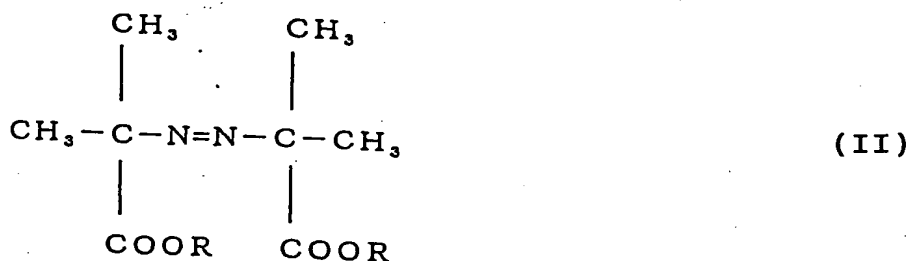
$$\ln (A) \leq 105.4 - 45126/B \quad (1)$$

$$\ln (A) \leq 2545.2/B - 15.82 \quad (2)$$

$$\ln (A) \geq 225.9 - 102168.8/B \quad (3)$$

$$\ln (A) \geq 1300.0/B - 15.74 \quad (4)$$

wherein A is an initiator concentration (a molar ratio of the initiator / the monomer); B is a polymerization temperature (°K); and ln is a symbol for a natural logarithm;



wherein R is alkyl or fluoroalkyl.

2. The process as claimed in Claim 1, where an inert solvent is further fed to the reactor in the polymerization step and instead that the initiator concentration and the

polymerization temperature satisfy the relationship represented by the above equations (1) to (4), the initiator concentration, the polymerization temperature and an inert solvent concentration satisfy a relationship represented by equations (5) to (8):

$$\ln \{A \times (1-C)^5\} \leq 105.4 - 45126/B \quad (5)$$

$$\ln \{A \times (1-C)^5\} \leq 2545.2/B - 15.82 \quad (6)$$

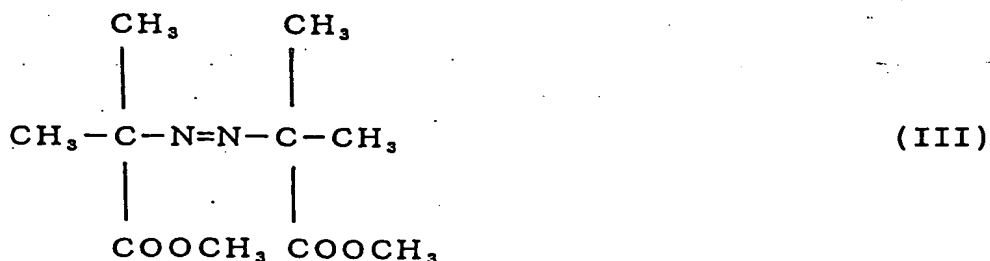
$$\ln \{A \times (1-C)^5\} \geq 225.9 - 102168.8/B \quad (7)$$

$$\ln \{A \times (1-C)^5\} \geq 1300.0/B - 15.74 \quad (8)$$

wherein A is an initiator concentration (a molar ratio of the initiator / the monomer); B is a polymerization temperature ($^{\circ}\text{K}$); C is the concentration of the inert solvent (the amount of the inert solvent (g) / the total amount of the monomer, the initiator, the chain transfer agent and the inert solvent fed into the reactor (g)); and ln is a symbol for a natural logarithm.

3. The process as claimed in Claim 1, where the monomer (mixture) contains at least one monomer selected from the group consisting of methyl methacrylate, a fluoroalkyl methacrylate and benzyl methacrylate.

4. The process as claimed in Claim 1, where in the polymerization step, methyl methacrylate is used as one methacrylate monomer, the content of methyl methacrylate in the monomer (mixture) is at least 80 wt%, and the compound represented by formula (III) is used as a radical polymerization initiator:



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5. The process as claimed in Claim 1, further comprising a feeding step of feeding a reaction mixture taken out from the reactor to a devolatilization step and a devolatilization step of separating and removing volatiles from the reaction mixture.

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6. The process as claimed in Claim 4, further comprising a feeding step of feeding a reaction mixture taken out from the reactor to a devolatilization step and a devolatilization step of separating and removing volatiles from the reaction mixture.

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7. The process as claimed in Claim 5, where in the polymerization step, the monomer (mixture) and the initiator are continuously fed to the reactor for bulk polymerization and in the feeding step, the reaction mixture is continuously fed from the reactor to the devolatilization step.

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8. The process as claimed in Claim 5, where a polymer content in the reaction mixture in the polymerization zone is 30 wt% to 70 wt% both inclusive.

9. The process as claimed in Claim 5, where in the polymerization step an alkyl mercaptan having 3 to 6 carbon atoms is further fed to the reactor for conducting

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polymerization.

10. The process as claimed in Claim 5, further comprising a volatile purification step, where the volatiles separated and removed in the devolatilization step are
5 purified using a catalyst containing at least one element selected from the group of copper, cobalt, nickel and manganese in the presence of molecular oxygen and further in the presence of a compound containing at least chlorine.

11. A process for manufacturing an optical fiber
10 comprising feeding the (co)polymer prepared by the process as claimed in Claim 5 and another polymer having a different refractive index to a multi-component spinning nozzle for spinning.

12. A process for manufacturing an optical fiber
15 comprising feeding at least two (co)polymers mutually different in a copolymer composition and in a refractive index prepared by the process as claimed in Claim 5 to a multi-component spinning nozzle for spinning by
concentrically piling the polymers in a manner that a
20 refractive index is reduced from the center toward the periphery.

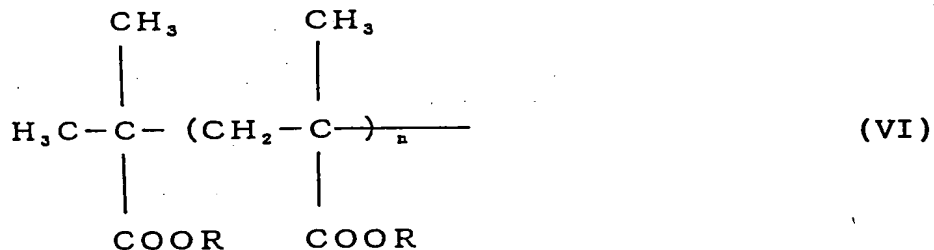
13. A process for manufacturing an optical fiber comprising feeding a core material comprising a (co)polymer prepared by the process as claimed in Claim 1 with other
25 (co)polymer to a multi-component spinning nozzle for spinning by assembling a plurality of islands, where each of the

islands has a core and the islands are separated from each other by other (co)polymer.

14. An optical fiber comprising a core, where in a core material, a content of sulfur atoms which are bound to a (co)polymer is 200 ppm to 1000 ppm both inclusive while a content of sulfur atoms which are not bound to the (co)polymer is 5 ppm or less.

15. The optical fiber as claimed in Claim 14, where a content of sulfur atoms which are not bound to the (co)polymer is 1 ppm or less.

16. The optical fiber as claimed in Claim 14, where the (co)polymer in the core material has a molecular terminal structure represented by formula (VI) derived from a radical initiator:

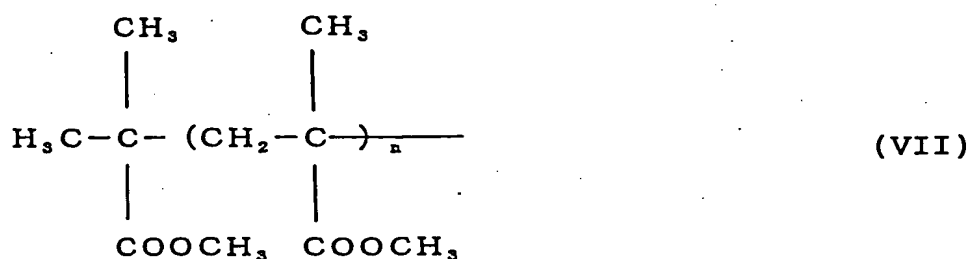


wherein R is alkyl or fluoroalkyl and n is a natural number of 1 or more.

17. The optical fiber as claimed in Claim 14, where the core material comprises a homopolymer of methyl methacrylate or a copolymer of methyl methacrylate and other copolymerizable monomer.

18. The optical fiber as claimed in Claim 17, where

the (co)polymer in the core material has a molecular terminal structure represented by formula (VII) derived from a radical initiator:



wherein n is a natural number of 1 or more.

19. The optical fiber as claimed in Claim 14, where the core material comprises two or more (co)polymer whose copolymer composition and refractive index are mutually different, which are concentrically piled such that refractive indices are sequentially reduced from the core center to the periphery.

20. The optical fiber as claimed in Claim 19, where the core material is selected from the group consisting of a homopolymer of methyl methacrylate, a copolymer of methyl methacrylate and a fluoroalkyl methacrylate and a copolymer of methyl methacrylate and benzyl methacrylate.

21. The optical fiber as claimed in Claim 14, where there are assembled a plurality of islands, where each of the islands has a core and the islands are separated from each other by other (co)polymer.

22. The optical fiber as claimed in Claim 19, where there are assembled a plurality of islands, where each of the

islands has a core and the islands are separated from each other by other (co)polymer.

23. An optical fiber cable comprising the optical fiber as claimed in Claim 14 and a coating layer on the outer surface of said optical fiber.

24. An optical fiber cable with a plug comprising the optical fiber cable as claimed in Claim 23 and a plug being attached to an end of said optical fiber.

25. A process for manufacturing an optical fiber comprising the steps of:

feeding a polymerization initiator, an alkyl mercaptan having 3 to 6 carbon atoms and a monomer or a mixture of two or more monomers into a reactor to form a reaction mixture containing a (co)polymer;

feeding the reaction mixture into a vent-type devolatilization extruder by directly spraying the mixture to a screw in an inlet in the vent-type devolatilization extruder under a reduced pressure through a small hole or slit for removing volatiles to provide a (co)polymer; and

forming an optical fiber using the (co)polymer as a core material,

where a feed rate of the reaction mixture to the vent-type devolatilization extruder and screw diameter and screw revolution speed in the vent-type devolatilization extruder satisfy the following relationship of equation (9):

$$Q \leq 0.002 \times \phi^2 \times \sqrt{N} \quad (9)$$

wherein Q is a feed rate of the reaction mixture (L/hr); ϕ is a screw diameter (mm); and N is a screw revolution speed (rpm).

26. The process as claimed in Claim 25, where one of
5 the monomers fed into the reactor is methyl methacrylate.

27. The process for manufacturing an optical fiber as claimed in Claim 17, comprising the steps of:

feeding a polymerization initiator, an alkyl
mercaptan having 3 to 6 carbon atoms and methyl methacrylate
10 monomer or a mixture of methyl methacrylate and other
copolymerizable monomer into a reactor to produce a reaction
mixture containing a methyl methacrylate (co)polymer in 30 to
60 wt%;

feeding the reaction mixture preheated to 170 to
15 205°C and compressed to a pressure equal to or higher than a
vapor pressure of methyl methacrylate at the preheating
temperature into a vent-type devolatilization extruder for
removing volatiles to obtain a methyl methacrylate
(co)polymer; and

20 forming an optical fiber using the (co)polymer as a
core material,

where the reaction mixture is fed into a vent-type
devolatilization extruder by directly spraying the mixture to
a screw in an inlet in the vent-type devolatilization
25 extruder under a reduced pressure through a small hole or a
narrow slit; and at least in the most downstream vent of the

vent-type devolatilization extruder, a temperature and a pressure are 230 to 270°C and 50 Torr or less, respectively.